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BMJ Open

Cannabis use among workers with work-related injuries and illnesses: results from a cross-sectional study of workers' compensation claimants in Ontario, Canada

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2023-072994
Article Type:	Original research
Date Submitted by the Author:	19-Feb-2023
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Keywords:	OCCUPATIONAL & INDUSTRIAL MEDICINE, EPIDEMIOLOGIC STUDIES, PUBLIC HEALTH

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Cannabis use among workers with work-related injuries and illnesses: results from a cross-sectional study of workers' compensation claimants in Ontario, Canada

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Text word count: 3,220

Abstract word count: 298

Number of tables: 4

Number of figures: 1

Number of supplementary files: 0

Keywords: cannabis, occupational injury, workers' compensation, workers, pain, sleep

ABSTRACT

Objectives: Little is known about how workers use cannabis following a work-related injury/illness, including whether they receive clinical guidance. The objective was to compare characteristics of workers using and not using cannabis after a work-related injury/illness and describe patterns of use.

Design: Descriptive cross-sectional study.

Participants and Setting: Workers who had experienced a work-related injury/illness resulting in one or more days of lost-time compensated by the workers’ compensation authority in Ontario, Canada (n=1,196).

Methods: Participants were interviewed 18- or 36-months after their injury/illness. Participants were asked about their past-year cannabis use, including whether their use was for the treatment of conditions arising from their work-related condition. Sociodemographic, work, and health characteristics were compared across cannabis groups: no past-year use; use for the work-related condition; use unrelated to the work-related condition. Cannabis use reasons and patterns, perceived impact, and healthcare provider engagement were described.

Results: In total, 27.4% reported using cannabis (14.1% for their work-related condition). Compared to those not using cannabis and those using cannabis unrelated to their condition, workers using cannabis for their condition were less likely to be working and more likely to have pain interference, psychological distress, and sleep problems. Those using cannabis for their condition reported cannabis allowed decreased use of prescription medications (38.8%). No differences were observed in medical authorizations for use among those using cannabis for

their condition (20.4%) or unrelated to their condition (15.7%). Healthcare provider guidance on use was more common among those using cannabis for their condition, however, two thirds of this group did not receive guidance.

Conclusions: Cannabis may be used to manage the consequences of work-related injuries/illnesses, particularly for those struggling with recovery, yet most do not receive clinical guidance. It is important that healthcare providers caring for injured workers speak with them about their cannabis use.

Strengths and limitations

- This is one of the first studies to document information on workers' use of cannabis to manage the symptoms from their work-related injuries and illnesses.
- The large sample of workers included in this study was drawn from a population sampling frame.
- The cross-sectional study design should be considered when interpreting the findings from analyses comparing cannabis use groups on physical and mental health indices.
- Data on cannabis use patterns in the early period after injury/illness onset are not available.

INTRODUCTION

Cannabis is one of the most widely used psychoactive substances in the world.(1) In Canada, where the use of cannabis is legal, approximately 20% of Canadians 18 years of age and older (almost 6.0 million people) reported using cannabis in the previous 3 months in 2020.(2) Similarly, 19.6% of adults in the United States (equivalent to nearly 50 million adults) used cannabis in 2021.(3) Beyond recreational reasons for use, there is growing public interest in using cannabis for therapeutic purposes.(4-6) In North America, data suggest approximately half of all adults using cannabis are doing so at least in part for therapeutic purposes.(7, 8) Frequently reported therapeutic reasons for use include pain, anxiety, depression and sleep problems,(9-11) although the evidence to support its use beyond a small number of defined conditions is limited.(12-14)

An important population subgroup who may be more likely to use cannabis for therapeutic purposes are individuals with work-related injuries and illnesses. In 2020, there were 665,120 workers' compensation claims for work-related injuries and illnesses registered across Canada, of which 253,397 (38%) required time off work.(15) In the United States, 2.6 million non-fatal work-related injuries and illnesses were reported by private industry employers in 2021.(16) These injuries and illnesses can have profound physical, psychological, and financial impacts for workers,(17-20) with workers frequently experiencing elevated levels of pain, depression, and sleep problems following their injuries/illnesses.(18, 21) Media reports suggest some workers are turning to cannabis to treat the symptoms resulting from their work-related conditions.(22-

25) Our research team also demonstrated that 30.7% of workers, when interviewed 18 months after a work-related injury/illness, had used cannabis in the past year.(26)

Beyond this, we know virtually nothing about patterns of cannabis use in this group, including therapeutic use specifically for the work-related condition. The extent to which healthcare providers provide guidance to these workers regarding their cannabis use is also not known, despite the important role they play in the care of patients who have experienced work-related injuries and illnesses.(27, 28) The liberalization of cannabis policy occurring worldwide makes this issue particularly salient. Using data collected from a sample of workers' compensation claimants in Ontario, Canada, the objective of this study is to: 1) compare the characteristics of workers using cannabis after a work-related injury or illness to those not using cannabis; and 2) compare patterns of cannabis use among workers using cannabis for their work-related injury/illness to those using cannabis unrelated to their work-related injury/illness, including whether they received a medical authorization to use and access cannabis, or guidance on their cannabis use from a healthcare provider.

METHODS

Sample and recruitment

Cross-sectional data were drawn from the Ontario Life After Work Injury Study (OLAWIS), pooling two cohorts exploring the health and labour market outcomes of workers in Ontario, Canada following a work-related injury or illness (herein referred to as work-related

condition).(26) Eligible participants were at least 18 years of age, able to conduct an interview in English or French, and had a work-related condition resulting in one or more days of lost-time compensated by the provincial workers' compensation authority (Ontario Workplace Safety & Insurance Board, WSIB). The WSIB oversees a single-payer, publicly administered insurance system to compensate eligible workers with work-related injuries and illnesses for time missed from work, health care costs, permanent disability, and rehabilitative services. Approximately 70% of employers in Ontario are required to obtain coverage from the WSIB. In each of 2018 and 2019, the WSIB administered benefits for approximately 200,000 compensation claims, of which 67,000 were claims for lost time at work.

In both cohorts, claimants with longer durations of work absence were oversampled. Participant recruitment for OLAWIS1 occurred between June 2019 and March 2020, approximately 18 months following onset of their work-related condition. From randomly sampled monthly quotas of lost-time claimants meeting eligibility criteria, 2,816 randomly sampled claimants were contacted, of which 1,674 (59.4%) agreed to share their contact information with the research team. Subsequently, a survey services contractor contacted consenting workers, completing interviews with 1,132 claimants (40.2% of eligible claimants, 87.8% of eligible claimants successfully contacted). Among participants, 358 (31.6%) were in the short-duration claim sample (3 months or less), and 774 (68.3%) were in the long-duration claim sample (more than 3 months). From this group of OLAWIS1 participants, 631 (55.7% of the original cohort) were interviewed again at 36 months (February to October 2021), with an

additional module of cannabis use questions included in the 36-month interview only. This subset of participants (n=631) was included in the current analysis.

Participant recruitment for OLAWIS2 occurred between September and November 2021, approximately 18 months following onset of their work-related condition. From a census of all eligible claimants, 2,309 randomly sampled claimants were contacted, of which a survey services contractor completed interviews with 700 claimants (30.3% of eligible claimants). Among OLAWIS2 participants, 395 (56.4%) were in the short-duration claim sample, and 305 (43.6%) were in the long-duration claim sample. The final pooled sample was 1,331.

Details on the original OLAWIS study are available elsewhere.⁽²⁶⁾ All respondents provided informed consent to participate and ethics approval was obtained from the University of Toronto Health Sciences Research Ethics Board (protocol numbers 37525 and 41560). Patients and the public were not involved in the design, conduct, reporting, or dissemination plans of this research.

Data collection and study measures

Data were collected via telephone interviews (n=1,079) or self-administered online questionnaires (n=252), depending on respondent preference. Measures relevant to this analysis were obtained from previous cohort studies of workers^(17, 29, 30) and from the Canadian Community Health Survey (CCHS),⁽³¹⁾ when available. Among consenting

participants, WSIB administrative data related to the work-related condition were also obtained.

Cannabis use status

The primary exposure of interest was cannabis use status. Participants were asked about the frequency of their past-year cannabis use on a 7-point scale, ranging from never to every day.(32) Participants reporting use on more than one occasion in the past year were asked whether they were currently using or had used cannabis in the past 12 months for the treatment of conditions arising from their work-related injury or illness (yes/no). Using this information, participants were categorized into one of three categories to describe their cannabis use status: no past-year use, past-year use for their work-related condition, and past-year use unrelated to their work-related condition.

Cannabis use details

Participants reporting past-year cannabis use were asked detailed questions about their use. This included whether they regularly used cannabis before their work-related condition and, among workers reporting use for their work-related condition, whether they started using cannabis because of their work-related condition. Data were also obtained on the main method of cannabis consumption, whether the cannabis they used made them feel high, the general purpose for use (medical, non-medical, mixed), and specific therapeutic reasons for use. Participants were asked whether their use of cannabis allowed them to decrease their use of

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3 prescription medication and alcohol. They were also asked to rate the impact of cannabis use
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5 on their physical and mental health. Finally, questions were asked about their primary source
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7 for obtaining cannabis, whether they had received a medical authorization from their
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9 healthcare provider to use cannabis, and if a healthcare provider had provided them with
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11 guidance on their cannabis use.
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19 ***Sociodemographic, work, condition, and health characteristics***

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21 Self-reported data were collected on age, sex, birth country, highest level of education,
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23 household income, self-reported financial difficulties in the past year, and employment status
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25 at the time of interview. Information on the nature of the original work-related injury/illness
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27 was obtained from WSIB administrative data for participants who consented to link their survey
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29 data (n=1,191).
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37 Information was collected on the health characteristics of the sample. Participants were asked
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39 to report if they were receiving healthcare for their work-related condition at the time of
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41 interview and, if not, whether they had received healthcare previously. Participants were also
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43 asked about their pain. Using an item from the Short-Form 12,(33) participants were asked to
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45 indicate how much pain interfered with their normal work in the past 4 weeks, with response
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47 options of not at all, a little bit, moderately, quite a bit, and extremely. Those indicating they
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49 had experienced pain interference were asked to rate their current pain intensity from 0 (no
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51 pain) to 10 (pain as bad as could be).(34) Using items from the CCHS,(32) participants were also
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asked about their use of opioids in the past year, their self-rated general health status, and how frequently they experienced trouble going to or staying asleep. The Kessler Psychological Distress Scale (K6)(35) was used to measure psychological distress, with total scores ranging from 0 to 24, and scores of 13 or more indicative of severe distress.(36)

Analysis

Analyses were completed using SAS 9.4 (SAS Institute, Cary, NC, USA). After pooling the 18- and 36-month samples (n=1,331), respondents with missing data required to classify them into one of the cannabis use status categories (n=30) were removed (Figure 1). Respondents missing data on sociodemographic, work, condition, and/or health-related variables were also removed (n=105). Participants missing information on household income or nature of injury/illness were assigned a missing category due to the amount of missing. This left 1,196 respondents (n=868 no use, n=169 use for work-related condition, n=159 use unrelated to the work-related condition). Descriptive statistics were calculated along with Chi square and Kruskal-Wallis statistics, comparing respondents in each of the cannabis use groups on their sociodemographic, work, condition, and health-related characteristics.

Of the 328 respondents reporting past-year cannabis use, 18 did not complete the cannabis module, and an additional 23 were missing responses for at least one cannabis-specific question, leaving a sample of 287 respondents: 147 reporting use for their work-related

condition and 140 using cannabis unrelated to their work-related condition. Groups were compared on their cannabis use patterns using descriptive statistics.

RESULTS

Table 1 presents sociodemographic, work, and condition characteristics across cannabis use status. In total, 72.6% reported no past-year cannabis use, 14.1% reported use for their work-related condition, and 13.3% reported use unrelated to their work-related condition. No statistical difference in cannabis use status was present between the 18- and 36-month samples. Respondents reporting use unrelated to their work-related condition were, on average, younger (mean 42.3) than those using for their work-related condition (mean 46.0) and those not using cannabis (mean 49.4) ($p<.0001$). Those who used cannabis for their work-related condition or unrelated to the work-related condition were more likely to be male (58.0% and 58.5%, respectively), than were those who did not use cannabis (49.7%) ($p=0.03$). Similarly, those who used cannabis for the WRC and unrelated to the WRC were more likely to be born in Canada (87.6% and 88.7%, respectively) than were those who did not use cannabis (73.0%) ($p<.0001$). A higher percentage of respondents reporting use for their work-related condition reported having concerning or serious financial difficulties in the past year (47.9%), to indicate they were not working (42.0%), and to have a longer claim duration (68.1%) than did those using cannabis unrelated to their work-related condition and those not using cannabis (all $p<.0001$). Musculoskeletal disorders and injuries were the most common type of condition in all groups.

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Table 1. Sociodemographic and work characteristics of the study sample, overall and stratified by cannabis use status

Characteristics	Overall (n=1,196)	Did not use cannabis in past 12 months (n=868)	Used cannabis for WRC (n=169)	Used cannabis unrelated to WRC (n=159)	P value ¹
Cohort sample, n (%)					0.2810
18 months after WRC	612 (51.0)	456 (52.4)	79 (47.0)	77 (47.5)	
36 months after WRC	588 (49.0)	414 (47.6)	89 (53.0)	85 (52.5)	
Age, mean (SD), median	48.0 (12.8), 50.0	49.4 (12.4), 52.0	46.0 (13.1), 48.0	42.3 (12.9), 41.0	<.0001
Sex, n (%)					0.0298
Male	622 (52.0)	431 (49.7)	98 (58.0)	93 (58.5)	
Female	574 (48.0)	437 (50.4)	71 (42.0)	66 (41.5)	
Country of birth, n (%)					<.0001
Canada	923 (77.2)	634 (73.0)	148 (87.6)	141 (88.7)	
Other	273 (22.8)	234 (27.0)	21 (12.4)	18 (11.3)	
Highest level of education achieved, n (%)					0.7975
High school or less	308 (25.8)	219 (25.2)	46 (27.2)	43 (27.0)	
At least some post- secondary	888 (74.3)	649 (74.8)	123 (72.8)	116 (73.0)	
Household income in 2020, n (%)					0.0497
<\$40,000	150 (12.5)	101 (11.6)	31 (18.3)	18 (11.3)	
\$40,000 to <\$70,000	271 (22.7)	193 (22.2)	51 (30.2)	27 (17.0)	
\$70,000 to <\$100,000	209 (17.5)	151 (17.4)	24 (14.2)	34 (21.4)	
\$100,000 to <\$130,000	189 (15.8)	133 (15.3)	26 (15.4)	30 (18.9)	
≤\$130,000	230 (19.2)	175 (20.2)	22 (13.0)	33 (20.8)	
Missing	147 (12.3)	115 (13.3)	15 (8.9)	17 (10.7)	
Financial difficulties in past 12 months, n (%)					<.0001
None	725 (60.6)	548 (63.1)	74 (43.8)	103 (64.8)	
Minor	93 (7.8)	64 (7.4)	14 (8.3)	15 (9.4)	
Concerning	162 (13.6)	107 (12.3)	34 (20.1)	21 (13.2)	
Very concerning	114 (9.5)	73 (8.4)	27 (16.0)	14 (8.8)	
Very serious	102 (8.5)	76 (8.8)	20 (11.8)	6 (3.8)	
Employment status at time of interview, n (%)					<.0001
Working	861 (72.0)	645 (74.3)	98 (58.0)	118 (74.2)	
Not working	335 (28.0)	223 (25.7)	71 (42.0)	41 (25.8)	

Characteristics	Overall (n=1,196)	Did not use cannabis in past 12 months (n=868)	Used cannabis for WRC (n=169)	Used cannabis unrelated to WRC (n=159)	P value ¹
Claim duration, n (%)					<.0001
Short duration (≤ 3 months)	524 (43.8)	380 (43.8)	54 (32.0)	90 (56.6)	
Long duration (> 3 months)	672 (56.2)	488 (56.2)	115 (68.1)	69 (43.4)	
Original work-related condition, n (%)					0.2569
Head injury	139 (11.6)	95 (10.9)	23 (13.6)	21 (13.2)	
Abrasions, cuts, lacerations	117 (9.8)	86 (9.9)	13 (7.7)	18 (11.3)	
Musculoskeletal disorders and injuries	511 (42.7)	360 (41.5)	86 (50.9)	65 (40.9)	
Fractures and dislocations	144 (12.0)	107 (12.3)	16 (9.5)	21 (13.2)	
Other conditions	143 (12.0)	108 (12.4)	14 (8.3)	21 (13.2)	
Missing	142 (11.9)	112 (12.9)	17 (10.1)	13 (8.2)	

Abbreviations: SD, standard deviation; WRC, work-related condition

¹ Comparing respondents not using cannabis, respondents using cannabis for their work-related condition, and those using cannabis unrelated to their work-related condition.

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Health-related characteristics across cannabis use status are described in Table 2. Statistically significant differences were observed between groups across most characteristics, with respondents using cannabis for their work-related condition more likely to report current healthcare for their condition (38.5%), quite a bit or extreme pain interference with their work (48.5%), and greater pain intensity due to their work-related condition (mean 5.1). Opioid use was more commonly reported among those using cannabis for their work-related condition (40.2%) compared to the other two groups, although this did not reach statistical significance. Poor self-reported general health, greater psychological distress, and sleep difficulties were also more common among respondents using cannabis for their work-related condition compared to those using unrelated to their condition and those not using cannabis.

Table 2. Health-related characteristics of the study sample, overall and stratified by cannabis use status

Characteristics	Overall (n=1,196)	Did not use cannabis in past 12 months (n=868)	Used cannabis for WRC (n=169)	Used cannabis unrelated to WRC (n=159)	P value ¹
Received healthcare for work-related condition, n (%)					<.0001
Yes, currently	261 (21.8)	177 (20.4)	65 (38.5)	19 (12.0)	
Yes, previously	796 (66.6)	581 (66.9)	93 (55.0)	122 (76.7)	
No	139 (11.6)	110 (12.7)	11 (6.5)	18 (11.3)	
Pain interfered with normal work in past 4 weeks, n (%)					<.0001
Not at all	300 (25.1)	233 (26.8)	16 (9.5)	51 (32.1)	
A little bit/Moderately	555 (46.4)	407 (46.9)	71 (42.0)	77 (48.4)	
Quite a bit/Extremely	341 (28.5)	228 (26.3)	82 (48.5)	31 (19.5)	
Current pain intensity due to WRC, mean (SD), median²	3.9 (2.9), 4.0	3.9 (2.8), 4.0	5.1 (2.6), 5.0	2.4 (2.7), 2.0	<.0001
Used opioids in past 12 months, n (%)³					0.0748
Yes	410 (34.3)	297 (34.2)	68 (40.2)	45 (28.3)	
No	786 (65.7)	571 (65.8)	101 (59.8)	114 (71.7)	
General health status, n (%)					<.0001
Good/Very good/Excellent	846 (70.7)	624 (71.9)	93 (55.0)	129 (81.1)	
Poor/Fair	350 (29.3)	244 (28.1)	76 (45.0)	30 (18.9)	
Kessler 6 psychological distress score, n (%)					<.0001
0	188 (15.7)	159 (18.3)	6 (3.6)	23 (14.5)	
1-12	841 (70.3)	605 (69.7)	119 (70.4)	117 (73.6)	
13+	167 (14.0)	104 (12.0)	44 (26.0)	19 (12.0)	
Experienced trouble going to or staying asleep in past 12 months, n (%)					<.0001
Never/Rarely	334 (27.9)	264 (30.4)	20 (11.8)	50 (31.5)	
Sometimes	368 (30.8)	274 (31.6)	44 (26.0)	50 (31.5)	
Most/All of the time	494 (41.3)	330 (38.0)	105 (62.1)	59 (37.1)	

Abbreviations: SD, standard deviation; WRC, work-related condition

¹ Comparing respondents not using cannabis, respondents using cannabis for their work-related condition, and those using cannabis unrelated to their work-related condition.² Among respondents reporting pain interference in previous 4 weeks (n=896)³ Use of any codeine products, oxycodone products or any other opioid products (e.g., hydromorphone, morphine), with or without prescription.

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Table 3 presents the characteristics of cannabis use among those reporting past-year use of cannabis. Among those who reported using cannabis for their work-related condition, 50.3% reported that they began to use cannabis because of the condition. Compared to respondents using cannabis unrelated to their work-related condition, those using cannabis for their work-related condition were more likely to report daily use, but were less likely to report using cannabis that makes them high. Smoking and vaping, followed by edibles, were the main method of consumption among both groups, while use of oral oils/tinctures/capsules were more commonly reported by respondents using cannabis for their work-related condition. Respondents using cannabis for their condition were more likely to report using cannabis for medical (44.9%) or mixed purposes (46.3%), with pain, sleep, and mental health-related reasons most frequently cited as medical reasons for use. Finally, respondents using cannabis for their work-related condition were more likely than those using cannabis unrelated to their condition to perceive that the use of cannabis allowed them to decrease their use of prescription medications (mainly opioids [44%], non-opioid [42%] pain relievers, and anti-inflammatories [32%]) and alcohol in the past 12 months, and that it had a beneficial impact on their physical and mental health.

Table 3. Cannabis use patterns, reasons for use, and perceived impact of use among respondents completing the cannabis module (n=287), overall and stratified by use for their work-related condition

Characteristics	Overall (n=287)	Used cannabis for WRC (n=147)	Used cannabis unrelated to WRC (n=140)	p value ¹
Regular use before injury n(%)	150 (52.3)	70 (47.6)	80 (57.1)	0.1064
Started using cannabis because of their WRC, n (%)	--	74 (50.3)	--	--
Frequency of cannabis use in past 12 months, n (%)				0.0080
Less than once a month	58 (20.2)	23 (15.7)	35 (25.0)	
1-3 times a month	48 (16.7)	20 (13.6)	28 (20.0)	
Once a week	29 (10.1)	18 (12.2)	11 (7.9)	
More than once a week	56 (19.5)	28 (19.1)	28 (20.0)	
Daily	96 (33.5)	58 (39.5)	38 (27.1)	
Main method of consumption, n (%)				0.0262
Smoked, vaped	182 (63.4)	86 (58.5)	96 (68.6)	
Ate, drank	61 (21.3)	30 (20.4)	31 (22.1)	
Oral oil, tincture, capsules	33 (11.5)	25 (17.0)	8 (5.7)	
Other	11 (3.8)	6 (4.1)	5 (3.6)	
Most often use cannabis that makes them high/under influence, n (%)	153 (53.3)	58 (39.5)	95 (67.9)	<.0001
General purpose for use, n (%)				<.0001
Non-medical	73 (25.4)	13 (8.8)	60 (42.9)	
Medical	91 (31.7)	66 (44.9)	25 (17.9)	
Both medical and non-medical	123 (42.9)	68 (46.3)	55 (39.3)	
Most common therapeutic reasons for use, n (%)²				
Cope with stress/relax	196 (68.3)	100 (68.0)	96 (68.6)	0.9211
For physical pain	180 (62.7)	127 (86.4)	53 (37.9)	<.0001
Help sleep/insomnia	177 (61.7)	104 (70.8)	73 (52.1)	0.0012
Manage anxiety	119 (41.5)	77 (52.4)	42 (30.0)	0.0001
Cope with feelings of depression	79 (27.5)	49 (33.3)	30 (21.4)	0.0240
Use of cannabis allowed decreased use of prescription medications in the past 12 months, n (%)				<.0001
Yes	76 (26.5)	57 (38.8)	19 (13.6)	
No	116 (40.4)	49 (33.3)	67 (47.9)	
N/A - do not use medication	95 (33.1)	41 (27.9)	54 (38.6)	

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Characteristics	Overall (n=287)	Used cannabis for WRC (n=147)	Used cannabis unrelated to WRC (n=140)	p value ¹
Use of cannabis allowed decreased use of alcohol in the past 12 months, n (%)				0.0635
Yes	73 (25.4)	43 (29.3)	30 (21.4)	
No	156 (54.4)	70 (47.6)	86 (61.4)	
N/A - do not drink alcohol	58 (20.2)	34 (23.1)	24 (17.1)	
Perceived impact on physical health, n (%)				<.0001
Beneficial	194 (67.6)	122 (83.0)	72 (51.4)	
No Effect	83 (28.9)	20 (13.6)	63 (45.0)	
Harmful	10 (3.5)	5 (3.4)	5 (3.6)	
Perceived impact on mental health, n (%)				0.0041
Beneficial	186 (64.8)	106 (72.1)	80 (57.1)	
No effect	89 (31.0)	39 (26.5)	50 (35.7)	
Harmful	12 (4.2)	--	10 (7.1)	

Abbreviations: SD, standard deviation; WRC, work-related condition

¹ Comparing respondents using cannabis for their work-related condition and those using cannabis unrelated to their work-related condition.

² More than one reason could be selected.

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3 Most of the respondents (81.9%) did not have a medical authorization to use cannabis and
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5 obtained cannabis from legal sources (64.8%) or grew their own (18.1%). This did not
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7 significantly differ between groups (Table 4). Respondents using cannabis for their work-related
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9 condition were more likely to have obtained guidance from a health care provider on cannabis
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11 use (32.7%) compared to those using unrelated to their condition (17.1%) ($p=0.0024$). Among
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13 those receiving guidance, most reported obtaining guidance from a GP/family physician (51.4%)
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15 or a specialist physician (19.4%). Most commonly, participants reported receiving guidance on
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17 risks and side effects, benefits, and frequency of use (68.6% for each) and amount to take
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19 (62.9%) (data not shown).
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29 Prior to pooling the two samples, we ran a set of analyses to compare the findings in the 18-
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31 month sample to those in the 36-month sample. No statistical differences were found between
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33 the two cohorts, with one exception. Greater financial difficulties were more commonly
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35 reported among the 18-month sample ($p=0.0258$), although the pattern by cannabis use status
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37 was similar, which suggests this may have been a chance finding. Details are available upon
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39 request.
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Table 4. Authorization and guidance among respondents completing the cannabis module (n=287), overall and stratified by use for their work-related condition

Characteristics	Overall (n=287)	Used cannabis for WRC (n=147)	Used cannabis unrelated to WRC (n=140)	P value ¹
Has a medical authorization for cannabis use, n (%)				0.3021
Yes	52 (18.1)	30 (20.4)	22 (15.7)	
No	235 (81.9)	117 (79.6)	118 (84.3)	
Primary source of cannabis				0.8048
Grown – at home or by someone else	52 (18.1)	27 (18.4)	25 (17.9)	
Legal – storefront or online	186 (64.8)	97 (66.0)	89 (63.6)	
Illegal – storefront online or other	49 (17.1)	23 (15.7)	26 (18.6)	
Received guidance from a healthcare provider on cannabis use, n (%)				0.0024
Yes	72 (25.1)	48 (32.7)	24 (17.1)	
No	215 (74.9)	99 (67.4)	116 (82.9)	

Abbreviations: SD, standard deviation; WRC, work-related condition
¹ Comparing respondents using cannabis for their work-related condition and those using cannabis unrelated to their work-related condition.

DISCUSSION

We explored patterns of cannabis use among workers with a work-related injury or illness, a group who commonly experience physical and mental health symptoms for which they may perceive cannabis to be of therapeutic benefit. We found that 14.1% of our sample were using cannabis for their work-related condition, and another 13.3% were using cannabis unrelated to their condition. Compared to other respondents, workers using cannabis for their work-related condition demonstrated poorer health on a range of measures, yet consistently perceived cannabis to have a positive impact on their health. Importantly, among those using cannabis for their work-related condition, only one fifth reported having a medical authorization to use cannabis, much like respondents using cannabis unrelated to their condition. Two thirds of respondents using cannabis for their work-related condition had not received guidance from a healthcare provider.

Findings of this study demonstrate workers are turning to cannabis many months following the onset of their original work-related condition, mostly without medical guidance. While we are not aware of similar studies among workers with work-related injuries and illnesses, results are consistent with studies of other patient populations, which have found that individuals using cannabis for medical purposes are frequently not receiving guidance on their cannabis use from a healthcare provider.(37-39) Recent findings from the National Cannabis Survey also found that, among the 14% of Canadian respondents 16 years of age and over using cannabis for medical purposes, 78% did so without medical authorization.(40) Yet, some adults who self-medicate with cannabis also report a desire to access health professionals for advice related to

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their use.(41) A qualitative study of family physicians demonstrated they were often hesitant to guide patients on medical cannabis use, including a reluctance to authorize its use, due to concerns about the potential for harm and a feeling they lacked education about its therapeutic benefit.(42) Studies conducted in other jurisdictions and with other specialties have reported similar findings.(43)

Workers in this sample who reported using cannabis for their work-related conditions appear to be struggling with their recovery, demonstrating higher levels of pain, poor mental health, and sleep difficulties than other workers. They were also more likely to report not working at the time of interview. Conversely, when asked about the perceived impact of their cannabis use, the majority of workers using cannabis for their work-related condition reported beneficial effects on their physical and mental health. Approximately a third of these workers also reported decreasing their use of prescription medications and alcohol as a result of their cannabis use, consistent with a larger body of research demonstrating the substitution effects of cannabis.(44-46) Unfortunately, the cross-sectional design of this study limits interpretation of the findings on these recovery indices. Longitudinal studies should be conducted to better understand the impact of cannabis use in this population on recovery, including the impact on return-to-work.

Our study underscores the need for healthcare providers to be aware that members of their patient population who have experienced a work-related injury/illness may be using cannabis

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3 as a therapeutic measure to manage the physical and mental difficulties arising from their
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5 condition. With growing public interest in the use of cannabis for medical purposes,(4-6)
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7 greater accessibility to legal sources of cannabis,(47) and workers' compensation organizations
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9 increasingly developing formal policies on medical cannabis,(48) it is reasonable to assume
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11 healthcare providers will continue to encounter workers using cannabis for their work-related
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13 conditions in their practice. This represents an important opportunity for healthcare providers
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15 to speak candidly with workers about their cannabis use and ensure they are supplied with
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17 evidence-based information about potential harms and benefits, to enable an informed choice
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19 about safe and effective use. Guidance from healthcare providers is all the more important
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21 given information found on the internet directed at medical cannabis consumers may be
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23 biased.(49-51) In discussing cannabis use with this group of workers, healthcare providers may
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25 consider drawing from a recent clinical framework for assessing impairment risk from medical
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27 cannabis.(52)
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38 Our study provides novel information on workers' use of cannabis for their work-related
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40 conditions, a population for which little data exist. Participants were also recruited from a
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42 population sampling frame. There are, however, some limitations not yet described. Data were
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44 collected at 18 and 36 months after injury/illness onset and we lack information on how soon
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46 after injury/illness cannabis use was initiated. Information on trajectories of use should be
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48 captured in future inception cohorts. Qualitative studies may also help to elucidate workers'
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50 decision-making process around using cannabis for their work-related conditions, and the role
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52 of their healthcare providers in guiding those decisions. Given this study takes place in the
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context of legalized cannabis and public healthcare, generalizability of the findings to other policy contexts may be limited. Finally, the self-reported nature of the data may have led to some recall and social desirability bias.

Conclusion

A non-trivial proportion of workers use cannabis for their work-related injuries and illnesses, most commonly for pain, poor sleep and mental health. Although these workers report a beneficial impact of cannabis on their health, they are often using cannabis without medical guidance. It is important that healthcare providers caring for injured workers engage in conversations about the potential benefits and risks associated with the therapeutic use of cannabis.

Acknowledgements

We wish to express our appreciation to the members of our stakeholder advisory committee who provided input on the survey.

Competing Interests

Andrea D. Furlan is a member of the Ontario Workplace Safety & Insurance Board's Drug Advisory Committee. The authors have no other competing interests to declare.

Funding Statement

This work was supported by the Canadian Institutes of Health Research (CIHR) (grant number PJT-173241) and the Ontario Workplace Safety & Insurance Board (grant numbers LONG2018 and MUST2021). The Institute for Work & Health receives support from Ontario's Ministry of Labour, Immigration, Training and Skills Development. The funders had no role in the conduct of this study, in the writing of the report, or in the decision to submit the article for publication. All inferences, opinions, and conclusions drawn in this report are those of the authors and do not reflect those of the Province of Ontario.

Contributors

Cameron Mustard, Peter M. Smith, and Nancy Carnide conceived of the study. Cameron Mustard, Peter M. Smith, Nancy Carnide, and Andrea D. Furlan contributed to the study design,

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methods, and acquisition of funding. Colette N. Severin was the project coordinator and was responsible for development of the study instrument, ethics approval, recruitment, and data collection. Victoria Nadalin analyzed the data under supervision of Nancy Carnide and Peter M. Smith. All authors contributed to interpretation of the data. Victoria Nadalin wrote the initial draft of the manuscript and Nancy Carnide and Peter M. Smith made revisions. All authors critically reviewed and contributed to revising the manuscript for important intellectual content and approve this final version. Nancy Carnide agrees to act as guarantor of the work.

Data availability

Data are available upon reasonable request. Procedures to access data from this study are available through contacting the lead author (Nancy Carnide). Proposals for collaborative analyses will be considered by the study’s investigator team. The study questionnaire can be provided by contacting the lead author (Nancy Carnide).

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FIGURE LEGEND

Figure 1. Flow diagram of study participants included in the analysis

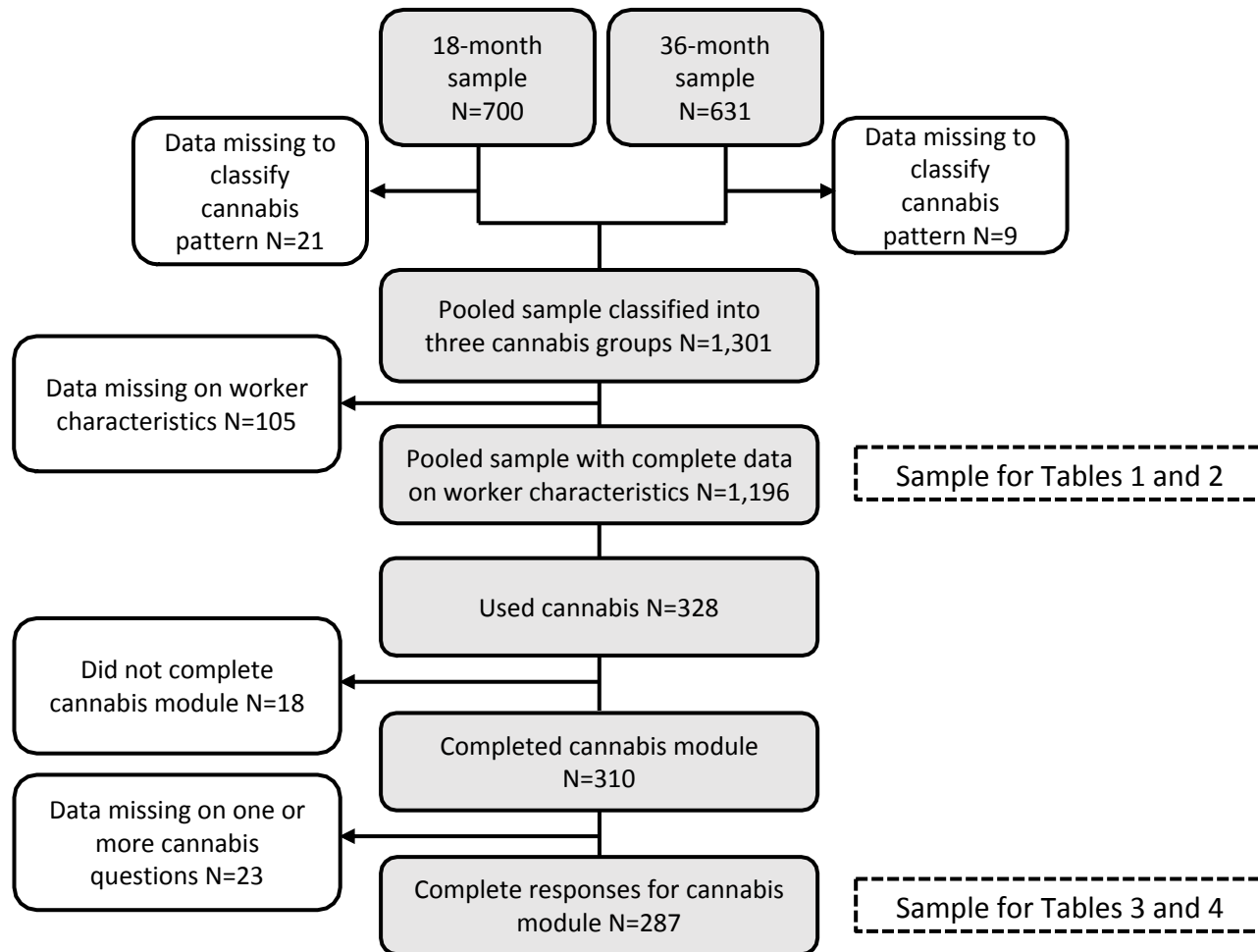


Figure 1. Flow diagram of study participants included in the analysis

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Manuscript: Injured workers are using cannabis, often without guidance from their healthcare providers: results from a cross-sectional study of workers’ compensation claimants in Ontario

Reporting Item			Page Number
Title and abstract			
Title	#1a	Indicate the study’s design with a commonly used term in the title or the abstract	1, 2
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	#3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	#4	Present key elements of study design early in the paper	5
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-7
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5-7
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-10
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give	7-10

information separately for for exposed and unexposed groups if applicable.

Bias	#9	Describe any efforts to address potential sources of bias	5-7
Study size	#10	Explain how the study size was arrived at	5-7; 10-11; Figure 1
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Tables 1-4
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	10-11
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	N/A
Statistical methods	#12c	Explain how missing data were addressed	10-11
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	N/A
Statistical methods	#12e	Describe any sensitivity analyses	N/A
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	5-7; 10-11; Figure 1
Participants	#13b	Give reasons for non-participation at each stage	5-7
Participants	#13c	Consider use of a flow diagram	Figure 1
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	11; 14; Tables 1-2
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	10-11

1	Outcome data	#15	Report numbers of outcome events or summary measures. Give	10-11
2			information separately for exposed and unexposed groups if	
3			applicable.	
4				
5				
6	Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted	11-20;
7			estimates and their precision (eg, 95% confidence interval). Make	Tables 1-4
8			clear which confounders were adjusted for and why they were	
9			included	
10				
11				
12				
13	Main results	#16b	Report category boundaries when continuous variables were	N/A
14			categorized	
15				
16				
17	Main results	#16c	If relevant, consider translating estimates of relative risk into	N/A
18			absolute risk for a meaningful time period	
19				
20				
21	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and	N/A
22			interactions, and sensitivity analyses	
23				
24				
25	Discussion			
26				
27	Key results	#18	Summarise key results with reference to study objectives	21
28				
29	Limitations	#19	Discuss limitations of the study, taking into account sources of	22; 23-24
30			potential bias or imprecision. Discuss both direction and magnitude	
31			of any potential bias.	
32				
33				
34				
35	Interpretation	#20	Give a cautious overall interpretation considering objectives,	21-23; 24
36			limitations, multiplicity of analyses, results from similar studies, and	
37			other relevant evidence.	
38				
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40	Generalisability	#21	Discuss the generalisability (external validity) of the study results	23-24
41				
42	Other			
43	Information			
44				
45				
46	Funding	#22	Give the source of funding and the role of the funders for the present	25
47			study and, if applicable, for the original study on which the present	
48			article is based	
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51 None The STROBE checklist is distributed under the terms of the Creative Commons Attribution License CC-
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BMJ Open

Cannabis use among workers with work-related injuries and illnesses: results from a cross-sectional study of workers' compensation claimants in Ontario, Canada

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2023-072994.R1
Article Type:	Original research
Date Submitted by the Author:	20-Jun-2023
Complete List of Authors:	Carnide, Nancy; Institute for Work and Health; University of Toronto Dalla Lana School of Public Health Nadalin, Victoria; Institute for Work and Health Mustard, Cameron; Institute for Work and Health; University of Toronto Dalla Lana School of Public Health Severin, Colette; Institute for Work and Health Furlan, Andrea; Institute for Work and Health; Toronto Rehabilitation Institute Smith, Peter; Institute for Work and Health; University of Toronto Dalla Lana School of Public Health
Primary Subject Heading:	Occupational and environmental medicine
Secondary Subject Heading:	Epidemiology, General practice / Family practice, Public health
Keywords:	OCCUPATIONAL & INDUSTRIAL MEDICINE, EPIDEMIOLOGIC STUDIES, PUBLIC HEALTH

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Cannabis use among workers with work-related injuries and illnesses: results from a cross-sectional study of workers' compensation claimants in Ontario, Canada

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Text word count: 3,865

Abstract word count: 299

Number of tables: 4

Number of figures: 1

Number of supplementary files: 0

Keywords: cannabis, occupational injury, workers' compensation, workers, pain, sleep

ABSTRACT

Objectives: Little is known about how workers use cannabis following a work-related injury/illness, including whether they receive clinical guidance. The objective was to compare characteristics of workers using and not using cannabis after a work-related injury/illness and describe use patterns.

Design: Cross-sectional study.

Setting and participants: Workers who experienced a work-related physical injury/illness resulting in one or more days of lost-time compensated by the workers' compensation authority in Ontario, Canada (n=1,196).

Methods: Participants were interviewed 18- or 36-months after their injury/illness. Participants were asked about their past-year cannabis use, including whether use was for the treatment of their work-related condition. Sociodemographic, work, and health characteristics were compared across cannabis groups: no past-year use; use for the work-related condition; use unrelated to the work-related condition. Cannabis use reasons, patterns, perceived impact, and healthcare provider engagement were described.

Results: In total, 27.4% of the sample reported using cannabis (14.1% for their work-related condition). Workers using cannabis for their condition were less likely to be working (58.0%) and more likely to have quite a bit/extreme pain interference (48.5%), psychological distress (26.0%), and sleep problems most/all the time (62.1%) compared to those not using cannabis (74.3%, 26.3%, 12.0%, 38.0%, respectively) and those using cannabis for other reasons (74.2%, 19.5%, 12.0%, 37.1%, respectively) (all p <0.0001). No significant differences were observed in

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3 medical authorisations for use among those using cannabis for their condition (20.4%) or
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5 unrelated to their condition (15.7%) ($p=0.3021$). Healthcare provider guidance was more
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7 common among those using cannabis for their condition (32.7%) compared to those using for
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9 other reasons (17.1%) ($p=0.0024$), however, two thirds of this group did not receive guidance.
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13 **Conclusions:** Cannabis may be used to manage the consequences of work-related
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15 injuries/illnesses, yet most do not receive clinical guidance. It is important that healthcare
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17 providers speak with injured workers about their cannabis use.
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23 24 **Strengths and limitations of this study**

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26
27 • The large sample of workers included in this study was drawn from a population
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29 sampling frame.
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32 • The cross-sectional study design should be considered when interpreting the findings
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34 from analyses comparing cannabis use groups on physical and mental health indices.
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37 • Data on cannabis use patterns in the early period after injury/illness onset are not
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39 available.
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42 • Due to the moderate response rates in this study, selection bias is possible if those who
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44 chose to participate differed from those who did not participate.
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INTRODUCTION

Cannabis is one of the most widely used psychoactive substances in the world.¹ In Canada, where the use of cannabis is legal, approximately 20% of Canadians 18 years of age and older (almost 6.0 million people) reported using cannabis in the previous 3 months in 2020.² Similarly, 19.6% of adults in the United States (equivalent to nearly 50 million adults) used cannabis in 2021.³ Beyond recreational reasons for use, there is growing public interest in using cannabis for therapeutic purposes.⁴⁻⁶ In North America, data suggest approximately half of all adults using cannabis are doing so at least in part for therapeutic purposes.^{7, 8} Frequently reported therapeutic reasons for use include pain, anxiety, depression and sleep problems,⁹⁻¹¹ although the evidence to support its use beyond a small number of defined conditions is limited.¹²⁻¹⁴

An important population subgroup who may be more likely to use cannabis for therapeutic purposes are individuals with work-related injuries and illnesses. In 2020, there were 665,120 workers' compensation claims for work-related injuries and illnesses registered across Canada, of which 253,397 (38%) required time off work.¹⁵ In the United States, 2.6 million non-fatal work-related injuries and illnesses were reported by private industry employers in 2021.¹⁶ These injuries and illnesses can have profound physical, psychological, and financial impacts for workers,¹⁷⁻²⁰ with workers frequently experiencing elevated levels of pain, depression, and sleep problems following their injuries/illnesses.^{18, 21} Media reports suggest some workers are turning to cannabis to treat the symptoms resulting from their work-related conditions.²²⁻²⁵ Our research team also demonstrated that 30.7% of workers, when interviewed 18 months after a work-related injury/illness, had used cannabis in the past year.²⁶

Beyond this, we know virtually nothing about patterns of cannabis use in this group, including therapeutic use specifically for the work-related condition. The extent to which healthcare providers provide guidance to these workers regarding their cannabis use is also not known, despite the important role they play in the care of patients who have experienced work-related injuries and illnesses.^{27, 28} The liberalisation of cannabis policy occurring worldwide makes this issue particularly salient. Using data collected from a sample of workers' compensation claimants in Ontario, Canada, the objective of this study is to: 1) compare the characteristics of workers using cannabis after a work-related injury or illness to those not using cannabis; and 2) compare patterns of cannabis use among workers using cannabis for their work-related injury/illness to those using cannabis unrelated to their work-related injury/illness, including whether they received a medical authorisation to use and access cannabis, or guidance on their cannabis use from a healthcare provider.

METHODS

Sample and recruitment

Cross-sectional data were drawn from the Ontario Life After Work Injury Study (OLAWIS), pooling two cohorts exploring the health and labour market outcomes of workers in Ontario, Canada following a physical work-related injury or illness (herein referred to as work-related condition).²⁶ Eligible participants were at least 18 years of age, able to conduct an interview in English or French, and had a work-related condition resulting in one or more days of lost-time

compensated by the provincial workers' compensation authority (Ontario Workplace Safety & Insurance Board, WSIB). The WSIB oversees a single-payer, publicly administered insurance system to compensate eligible workers with work-related injuries and illnesses for time missed from work, health care costs, permanent disability, and rehabilitative services. Approximately 70% of employers in Ontario are required to obtain coverage from the WSIB. In each of 2018 and 2019, the WSIB administered benefits for approximately 200,000 compensation claims, of which 67,000 were claims for lost time at work. Workers with a primary psychological injury, workers in the survivors programme or serious injury programme, and those who had a traumatic head injury resulting in communication impairment were excluded.

In both cohorts, claimants with longer durations of work absence were oversampled. Participant recruitment for OLAWIS1 occurred between June 2019 and March 2020, approximately 18 months following onset of their work-related condition. From randomly sampled monthly quotas of lost-time claimants meeting eligibility criteria, 2,816 randomly sampled claimants were contacted, of which 1,674 (59.4%) agreed to share their contact information with the research team. Subsequently, a survey services contractor contacted consenting workers, completing interviews with 1,132 claimants (40.2% of eligible claimants, 87.8% of eligible claimants successfully contacted). Among participants, 358 (31.6%) were in the short-duration claim sample (3 months or less), and 774 (68.3%) were in the long-duration claim sample (more than 3 months). From this group of OLAWIS1 participants, 631 (55.7% of the original cohort) were interviewed again at 36 months (February to October 2021), with an

additional module of cannabis use questions included in the 36-month interview only. This subset of participants (n=631) was included in the current analysis.

Participant recruitment for OLAWIS2 occurred between September and November 2021, approximately 18 months following onset of their work-related condition. From a census of all eligible claimants, 2,309 randomly sampled claimants were contacted, of which a survey services contractor completed interviews with 700 claimants (30.3% of eligible claimants). Among OLAWIS2 participants, 395 (56.4%) were in the short-duration claim sample, and 305 (43.6%) were in the long-duration claim sample. The final pooled sample was 1,331.

Details on the original OLAWIS study are available elsewhere.²⁶ All respondents provided informed consent to participate and ethics approval was obtained from the University of Toronto Health Sciences Research Ethics Board (protocol numbers 37525 and 41560).

Data collection and study measures

Data were collected via telephone interviews (n=1,079) or self-administered online questionnaires (n=252), depending on respondent preference. Measures relevant to this analysis were obtained from previous cohort studies of workers^{17, 29, 30} and from the Canadian Community Health Survey (CCHS),³¹ when available. Among consenting participants, WSIB administrative data related to the work-related condition were also obtained.

Cannabis use status

The primary exposure of interest was cannabis use status. Participants were asked about the frequency of their past-year cannabis use on a 7-point scale, ranging from never to every day.³² Participants reporting use on more than one occasion in the past year were asked whether they were currently using or had used cannabis in the past 12 months at least in part for the treatment of conditions arising from their work-related injury or illness (yes/no). Using this information, participants were categorised into one of three categories to describe their cannabis use status: no past-year use, past-year use for their work-related condition, and past-year use unrelated to their work-related condition. Note that workers endorsing use for their work-related condition may not have been using cannabis exclusively for this condition.

Cannabis use details

Participants reporting past-year cannabis use were asked detailed questions about their use. This included whether they regularly used cannabis before their work-related condition and, among workers reporting use for their work-related condition, whether they started using cannabis because of their work-related condition. Data were also obtained on the main method of cannabis consumption, whether the cannabis they used made them feel high, the general purpose for use (medical, non-medical, mixed), and specific therapeutic reasons for use. Participants were asked whether their use of cannabis allowed them to decrease their use of prescription medication and alcohol. They were also asked to rate the impact of cannabis use on their physical and mental health. Finally, questions were asked of respondents about their

primary source for obtaining cannabis, if a healthcare provider had provided them with guidance on their cannabis use, and whether they had received a medical authorisation from their healthcare provider to use cannabis. In Canada, while access to cannabis for non-medical use has been legal since 2018, a separate medical access stream has been maintained, in which healthcare providers may provide their patients with a medical authorisation document that formally supports their use of medical cannabis for a patient's given condition or set of symptoms. This document must provide information on the daily amount authorised to be used and the duration of authorised use. With this document, patients may choose to access their cannabis directly from a licensed producer who is authorised to sell to registered clients.

Sociodemographic, work, condition, and health characteristics

Self-reported data were collected on age, sex, birth country, highest level of education, household income, self-reported financial difficulties in the past year, and employment status at the time of interview. Information on the nature of the original work-related injury/illness was obtained from WSIB administrative data for participants who consented to link their survey data (n=1,065).

Information was collected on the health characteristics of the sample. Participants were asked to report if they were receiving healthcare for their work-related condition at the time of interview and, if not, whether they had received healthcare previously. Participants were also asked about their pain. Using an item from the Short-Form 12,³³ participants were asked to

indicate how much pain interfered with their normal work in the past 4 weeks, with response options of not at all, a little bit, moderately, quite a bit, and extremely. Those indicating they had experienced pain interference were asked to rate their current pain intensity from 0 (no pain) to 10 (pain as bad as could be).³⁴ Using items from the CCHS,³² participants were also asked about their use of opioids in the past year, their self-rated general health status, and how frequently they experienced trouble going to or staying asleep. The Kessler Psychological Distress Scale (K6)³⁵ was used to measure psychological distress, with total scores ranging from 0 to 24, and scores of 13 or more indicative of severe distress.³⁶

Analysis

Analyses were completed using SAS 9.4 (SAS Institute, Cary, NC, USA). After pooling the 18- and 36-month samples (n=1,331), respondents with missing data required to classify them into one of the cannabis use status categories (n=30) were removed (Figure 1). Respondents missing data on sociodemographic, work, condition, and/or health-related variables were also removed (n=105). Participants missing information on household income or nature of injury/illness were assigned a missing category due to the amount of missing. This left 1,196 respondents (n=868 no use, n=169 use for work-related condition, n=159 use unrelated to the work-related condition). Descriptive statistics were calculated along with Chi square and Kruskal-Wallis statistics, comparing respondents in each of the cannabis use groups on their sociodemographic, work, condition, and health-related characteristics.

Of the 328 respondents reporting past-year cannabis use, 18 did not complete the cannabis module, and an additional 23 were missing responses for at least one cannabis-specific question, leaving a sample of 287 respondents: 147 reporting use for their work-related condition and 140 using cannabis unrelated to their work-related condition. Groups were compared on their cannabis use patterns using descriptive statistics.

Patient and public involvement

None.

RESULTS

Table 1 presents sociodemographic, work, and condition characteristics across cannabis use status in the study sample. In total, 72.6% reported no past-year cannabis use, 14.1% reported use for their work-related condition, and 13.3% reported use unrelated to their work-related condition. No statistical difference in cannabis use status was present between the 18- and 36-month samples. Respondents reporting use unrelated to their work-related condition were, on average, younger (mean 42.3) than those using for their work-related condition (mean 46.0) and those not using cannabis (mean 49.4) ($p<.0001$). Those who used cannabis for their work-related condition or unrelated to the work-related condition were more likely to be male (58.0% and 58.5%, respectively), than were those who did not use cannabis (49.7%) ($p=0.03$). Similarly, those who used cannabis for their work-related condition and unrelated to their work-related condition were more likely to be born in Canada (87.6% and 88.7%, respectively)

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than were those who did not use cannabis (73.0%) ($p<.0001$). A higher percentage of respondents reporting use for their work-related condition reported having concerning or serious financial difficulties in the past year (47.9%) and a longer claim duration (68.1%) than did those using cannabis unrelated to their work-related condition and those not using cannabis (both $p<.0001$). Similarly, respondents using cannabis for their condition were more likely to report not working (42.0%) and less likely to report working with the at injury/illness employer (39.1%) ($p<.0001$). Musculoskeletal disorders and injuries were the most common type of condition in all groups.

Table 1. Sociodemographic and work characteristics of the study sample, overall and stratified by cannabis use status

Characteristics	Overall (n=1,196)	Did not use cannabis in past 12 months (n=868)	Used cannabis for work- related condition (n=169)	Used cannabis unrelated to work-related condition (n=159)	P value ¹
Cohort sample, n (%)					0.2810
18 months after work- related condition	612 (51.0)	456 (52.4)	79 (47.0)	77 (47.5)	
36 months after work- related condition	588 (49.0)	414 (47.6)	89 (53.0)	85 (52.5)	
Age, mean (SD), median	48.0 (12.8), 50.0	49.4 (12.4), 52.0	46.0 (13.1), 48.0	42.3 (12.9), 41.0	<.0001
Sex, n (%)					0.0298
Male	622 (52.0)	431 (49.7)	98 (58.0)	93 (58.5)	
Female	574 (48.0)	437 (50.4)	71 (42.0)	66 (41.5)	
Country of birth, n (%)					<.0001
Canada	923 (77.2)	634 (73.0)	148 (87.6)	141 (88.7)	
Other	273 (22.8)	234 (27.0)	21 (12.4)	18 (11.3)	
Highest level of education achieved, n (%)					0.7975
High school or less	308 (25.8)	219 (25.2)	46 (27.2)	43 (27.0)	
At least some post- secondary	888 (74.3)	649 (74.8)	123 (72.8)	116 (73.0)	
Household income in 2020, n (%)					0.0497
<\$40,000	150 (12.5)	101 (11.6)	31 (18.3)	18 (11.3)	
\$40,000 to <\$70,000	271 (22.7)	193 (22.2)	51 (30.2)	27 (17.0)	
\$70,000 to <\$100,000	209 (17.5)	151 (17.4)	24 (14.2)	34 (21.4)	
\$100,000 to <\$130,000	189 (15.8)	133 (15.3)	26 (15.4)	30 (18.9)	
≤\$130,000	230 (19.2)	175 (20.2)	22 (13.0)	33 (20.8)	
Missing	147 (12.3)	115 (13.3)	15 (8.9)	17 (10.7)	
Financial difficulties in past 12 months, n (%)					<.0001
None	725 (60.6)	548 (63.1)	74 (43.8)	103 (64.8)	
Minor	93 (7.8)	64 (7.4)	14 (8.3)	15 (9.4)	
Concerning	162 (13.6)	107 (12.3)	34 (20.1)	21 (13.2)	
Very concerning	114 (9.5)	73 (8.4)	27 (16.0)	14 (8.8)	
Very serious	102 (8.5)	76 (8.8)	20 (11.8)	6 (3.8)	

Characteristics	Overall (n=1,196)	Did not use cannabis in past 12 months (n=868)	Used cannabis for work- related condition (n=169)	Used cannabis unrelated to work-related condition (n=159)	P value ¹
Employment status at time of interview, n (%)					<.0001
Working with injury/illness employer	654 (54.7)	506 (58.3)	66 (39.1)	82 (51.6)	
Working with different employer	207 (17.3)	139 (16.0)	32 (18.9)	36 (22.6)	
Not working	335 (28.0)	223 (25.7)	71 (42.0)	41 (25.8)	
Claim duration, n (%)					<.0001
Short duration (≤3 months)	524 (43.8)	380 (43.8)	54 (32.0)	90 (56.6)	
Long duration (>3 months)	672 (56.2)	488 (56.2)	115 (68.1)	69 (43.4)	
Original work-related condition, n (%)					0.3121
Head injury	139 (11.6)	95 (10.9)	23 (13.6)	21 (13.2)	
Abrasions, cuts, lacerations	117 (9.8)	86 (9.9)	13 (7.7)	18 (11.3)	
Musculoskeletal disorders and injuries	520 (43.5)	367 (42.3)	87 (51.5)	66 (41.5)	
Fractures and dislocations	144 (12.0)	107 (12.3)	16 (9.5)	21 (13.2)	
Other conditions ²	145 (12.1)	110 (12.7)	14 (8.3)	21 (13.2)	
Missing	131 (11.0)	103 (11.9)	16 (9.5)	12 (7.8)	

Abbreviations: SD, standard deviation

¹ Comparing respondents not using cannabis, respondents using cannabis for their work-related condition, and those using cannabis unrelated to their work-related condition.

² Includes traumatic injuries (e.g., amputations, electrocutions) and illnesses (e.g., infectious and parasitic diseases, nervous system diseases, respiratory system diseases, systemic poisonings, and skin and subcutaneous tissue disorders).

Health-related characteristics across cannabis use status are described in Table 2. Statistically significant differences were observed between groups across most characteristics, with respondents using cannabis for their work-related condition more likely to report current healthcare for their condition (38.5%), quite a bit or extreme pain interference with their work (48.5%), and greater pain intensity due to their work-related condition (mean 5.1). Opioid use was more commonly reported among those using cannabis for their work-related condition (40.2%) compared to the other two groups, although this did not reach statistical significance. Poor self-reported general health, greater psychological distress, and sleep difficulties were also more common among respondents using cannabis for their work-related condition compared to those using unrelated to their condition and those not using cannabis.

Table 2. Health-related characteristics of the study sample, overall and stratified by cannabis use status

Characteristics	Overall (n=1,196)	Did not use cannabis in past 12 months (n=868)	Used cannabis for work-related condition (n=169)	Used cannabis unrelated to work-related condition (n=159)	P value ¹
Received healthcare for work-related condition, n (%)					<.0001
Yes, currently	261 (21.8)	177 (20.4)	65 (38.5)	19 (12.0)	
Yes, previously	796 (66.6)	581 (66.9)	93 (55.0)	122 (76.7)	
No	139 (11.6)	110 (12.7)	11 (6.5)	18 (11.3)	
Pain interfered with normal work in past 4 weeks, n (%)					<.0001
Not at all	300 (25.1)	233 (26.8)	16 (9.5)	51 (32.1)	
A little bit/Moderately	555 (46.4)	407 (46.9)	71 (42.0)	77 (48.4)	
Quite a bit/Extremely	341 (28.5)	228 (26.3)	82 (48.5)	31 (19.5)	
Current pain intensity due to work-related condition, mean (SD), median²	3.9 (2.9), 4.0	3.9 (2.8), 4.0	5.1 (2.6), 5.0	2.4 (2.7), 2.0	<.0001
Used opioids in past 12 months, n (%)³					0.0748
Yes	410 (34.3)	297 (34.2)	68 (40.2)	45 (28.3)	
No	786 (65.7)	571 (65.8)	101 (59.8)	114 (71.7)	
General health status, n (%)					<.0001
Good/Very good/Excellent	846 (70.7)	624 (71.9)	93 (55.0)	129 (81.1)	
Poor/Fair	350 (29.3)	244 (28.1)	76 (45.0)	30 (18.9)	
Kessler 6 psychological distress score, n (%)					<.0001
0	188 (15.7)	159 (18.3)	6 (3.6)	23 (14.5)	
1-12	841 (70.3)	605 (69.7)	119 (70.4)	117 (73.6)	
13+	167 (14.0)	104 (12.0)	44 (26.0)	19 (12.0)	
Experienced trouble going to or staying asleep in past 12 months, n (%)					<.0001
Never/Rarely	334 (27.9)	264 (30.4)	20 (11.8)	50 (31.5)	
Sometimes	368 (30.8)	274 (31.6)	44 (26.0)	50 (31.5)	
Most/All of the time	494 (41.3)	330 (38.0)	105 (62.1)	59 (37.1)	

Abbreviations: SD, standard deviation

¹ Comparing respondents not using cannabis, respondents using cannabis for their work-related condition, and those using cannabis unrelated to their work-related condition.² Among respondents reporting pain interference in previous 4 weeks (n=896)³ Use of any codeine products, oxycodone products or any other opioid products (e.g., hydromorphone, morphine), with or without prescription.

Table 3 presents the characteristics of cannabis use among those reporting past-year use of cannabis. Among those who reported using cannabis for their work-related condition, 50.3% reported that they began to use cannabis because of the condition. Compared to respondents using cannabis unrelated to their work-related condition, those using cannabis for their work-related condition were more likely to report daily use, but were less likely to report using cannabis that makes them high. Smoking and vaping, followed by edibles, were the main method of consumption among both groups, while use of oral oils/tinctures/capsules were more commonly reported by respondents using cannabis for their work-related condition. Respondents using cannabis for their condition were more likely to report using cannabis for medical (44.9%) or mixed purposes (46.3%), with pain, sleep, and mental health-related reasons most frequently cited as medical reasons for use. Finally, respondents using cannabis for their work-related condition were more likely than those using cannabis unrelated to their condition to perceive that the use of cannabis allowed them to decrease their use of prescription medications (mainly opioids [44%], non-opioid [42%] pain relievers, and anti-inflammatories [32%]) and alcohol in the past 12 months, and that it had a beneficial impact on their physical and mental health.

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Table 3. Cannabis use patterns, reasons for use, and perceived impact of use among respondents completing the cannabis module (n=287), overall and stratified by use for their work-related condition

Characteristics	Overall (n=287)	Used cannabis for work-related condition (n=147)	Used cannabis unrelated to work-related condition (n=140)	p value ¹
Regular use before injury n(%)	150 (52.3)	70 (47.6)	80 (57.1)	0.1064
Started using cannabis because of their work-related condition, n (%)	--	74 (50.3)	--	--
Frequency of cannabis use in past 12 months, n (%)				0.0080
Less than once a month	58 (20.2)	23 (15.7)	35 (25.0)	
1-3 times a month	48 (16.7)	20 (13.6)	28 (20.0)	
Once a week	29 (10.1)	18 (12.2)	11 (7.9)	
More than once a week	56 (19.5)	28 (19.1)	28 (20.0)	
Daily	96 (33.5)	58 (39.5)	38 (27.1)	
Main method of consumption, n (%)				0.0262
Smoked, vaped	182 (63.4)	86 (58.5)	96 (68.6)	
Ate, drank	61 (21.3)	30 (20.4)	31 (22.1)	
Oral oil, tincture, capsules	33 (11.5)	25 (17.0)	8 (5.7)	
Other	11 (3.8)	6 (4.1)	5 (3.6)	
Most often use cannabis that makes them high/under influence, n (%)	153 (53.3)	58 (39.5)	95 (67.9)	<.0001
General purpose for use, n (%)				<.0001
Non-medical	73 (25.4)	13 (8.8)	60 (42.9)	
Medical	91 (31.7)	66 (44.9)	25 (17.9)	
Both medical and non-medical	123 (42.9)	68 (46.3)	55 (39.3)	
Most common therapeutic reasons for use, n (%) ²				
Cope with stress/relax	196 (68.3)	100 (68.0)	96 (68.6)	0.9211
For physical pain	180 (62.7)	127 (86.4)	53 (37.9)	<.0001
Help sleep/insomnia	177 (61.7)	104 (70.8)	73 (52.1)	0.0012
Manage anxiety	119 (41.5)	77 (52.4)	42 (30.0)	0.0001
Cope with feelings of depression	79 (27.5)	49 (33.3)	30 (21.4)	0.0240

Characteristics	Overall (n=287)	Used cannabis for work-related condition (n=147)	Used cannabis unrelated to work-related condition (n=140)	p value ¹
Use of cannabis allowed decreased use of prescription medications in the past 12 months, n (%)				<.0001
Yes	76 (26.5)	57 (38.8)	19 (13.6)	
No	116 (40.4)	49 (33.3)	67 (47.9)	
N/A - do not use medication	95 (33.1)	41 (27.9)	54 (38.6)	
Use of cannabis allowed decreased use of alcohol in the past 12 months, n (%)				0.0635
Yes	73 (25.4)	43 (29.3)	30 (21.4)	
No	156 (54.4)	70 (47.6)	86 (61.4)	
N/A - do not drink alcohol	58 (20.2)	34 (23.1)	24 (17.1)	
Perceived impact on physical health, n (%)				<.0001
Beneficial	194 (67.6)	122 (83.0)	72 (51.4)	
No Effect	83 (28.9)	20 (13.6)	63 (45.0)	
Harmful	10 (3.5)	5 (3.4)	5 (3.6)	
Perceived impact on mental health, n (%)				0.0041
Beneficial	186 (64.8)	106 (72.1)	80 (57.1)	
No effect	89 (31.0)	39 (26.5)	50 (35.7)	
Harmful	12 (4.2)	--	10 (7.1)	

Abbreviations: SD, standard deviation

¹ Comparing respondents using cannabis for their work-related condition and those using cannabis unrelated to their work-related condition.

² More than one reason could be selected.

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Most of the respondents (81.9%) did not have a medical authorisation to use cannabis and obtained cannabis from legal sources (64.8%) or grew their own (18.1%). This did not significantly differ between groups (Table 4). Respondents using cannabis for their work-related condition were more likely to have obtained guidance from a health care provider on cannabis use (32.7%) compared to those using unrelated to their condition (17.1%) ($p=0.0024$). Among those receiving guidance, most reported obtaining guidance from a GP/family physician (51.4%) or a specialist physician (19.4%). Most commonly, participants reported receiving guidance on risks and side effects, benefits, and frequency of use (68.6% for each) and amount to take (62.9%) (data not shown).

Prior to pooling the two samples, we ran a set of analyses to compare the findings in the 18-month sample to those in the 36-month sample. No statistical differences were found between the two cohorts, with one exception. Greater financial difficulties were more commonly reported among the 18-month sample ($p=0.0258$), although the pattern by cannabis use status was similar, which suggests this may have been a chance finding. Details are available upon request.

Table 4. Authorisation and guidance among respondents completing the cannabis module (n=287), overall and stratified by use for their work-related condition

Characteristics	Overall (n=287)	Used cannabis for work-related condition (n=147)	Used cannabis unrelated to work-related condition (n=140)	P value ¹
Has a medical authorisation for cannabis use, n (%)				0.3021
Yes	52 (18.1)	30 (20.4)	22 (15.7)	
No	235 (81.9)	117 (79.6)	118 (84.3)	
Primary source of cannabis				0.8048
Grown – at home or by someone else	52 (18.1)	27 (18.4)	25 (17.9)	
Legal – storefront or online	186 (64.8)	97 (66.0)	89 (63.6)	
Illegal – storefront online or other	49 (17.1)	23 (15.7)	26 (18.6)	
Received guidance from a healthcare provider on cannabis use, n (%)				0.0024
Yes	72 (25.1)	48 (32.7)	24 (17.1)	
No	215 (74.9)	99 (67.4)	116 (82.9)	

Abbreviations: SD, standard deviation

¹ Comparing respondents using cannabis for their work-related condition and those using cannabis unrelated to their work-related condition.

DISCUSSION

We explored patterns of cannabis use among workers with a work-related injury or illness, a group who commonly experience physical and mental health symptoms for which they may perceive cannabis to be of therapeutic benefit. We found that 14.1% of our sample were using cannabis for their work-related condition, and another 13.3% were using cannabis unrelated to their condition. Compared to other respondents, workers using cannabis for their work-related condition demonstrated poorer health on a range of measures, yet consistently perceived cannabis to have a positive impact on their health. Importantly, among those using cannabis for their work-related condition, only one fifth reported having a medical authorisation to use cannabis, much like respondents using cannabis unrelated to their condition. Two thirds of respondents using cannabis for their work-related condition had not received guidance from a healthcare provider.

Findings of this study demonstrate workers are turning to cannabis many months following the onset of their original work-related condition, mostly without medical guidance. While we are not aware of similar studies among workers with work-related injuries and illnesses, results are consistent with studies of other patient populations, which have found that individuals using cannabis for medical purposes are frequently not receiving guidance on their cannabis use from a healthcare provider.³⁷⁻³⁹ Recent findings from the National Cannabis Survey also found that, among the 14% of Canadian respondents 16 years of age and over using cannabis for medical purposes, 78% did so without medical authorisation.⁴⁰ Yet, some adults who self-medicate with cannabis also report a desire to access health professionals for advice related to their use.⁴¹ A

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3 qualitative study of family physicians demonstrated they were often hesitant to guide patients
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5 on medical cannabis use, including a reluctance to authorise its use, due to concerns about the
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7 potential for harm and a feeling they lacked education about its therapeutic benefit.⁴² Studies
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9 conducted in other jurisdictions and with other specialties have reported similar findings.^{43, 44}
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16 Workers in this sample who reported using cannabis for their work-related conditions appear to
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18 be struggling with their recovery, demonstrating higher levels of pain, poor mental health, and
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20 sleep difficulties than other workers, which also parallel the most common therapeutic reasons
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22 reported for using cannabis. They were also more likely to report not working at the time of
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24 interview. Conversely, when asked about the perceived impact of their cannabis use, the
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26 majority of workers using cannabis for their work-related condition reported beneficial effects
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28 on their physical and mental health. Approximately a third of these workers also reported
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30 decreasing their use of prescription medications and alcohol as a result of their cannabis use,
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32 consistent with a larger body of research demonstrating the substitution effects of cannabis.⁴⁵⁻
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38 ⁴⁷ Unfortunately, as a result of the cross-sectional design of this study, we lack temporal
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40 information on cannabis use and these recovery indices, limiting interpretation of the direction
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42 of these findings. One potential explanation for these paradoxical findings is that workers with
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44 more severe symptoms may be more likely to pursue the use of cannabis as a therapeutic
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46 measure, particularly if other treatments have failed.⁴⁸⁻⁵⁰ Furthermore, given workers were
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48 asked their perceptions of the impact of use, it is possible that benefits were overstated.
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53 Longitudinal studies should be conducted to better understand the impact of cannabis use in
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55 this population on objective recovery measures, including the impact on return-to-work.
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Differences in patterns of use among workers using cannabis were also apparent. Workers using cannabis for their work-related condition used cannabis more frequently (70.8% at least once per week) compared with workers using cannabis unrelated to their condition (55.0%). Daily use was also more common among workers using cannabis for their work-related condition (39.5% versus 27.1%). Prior studies have demonstrated variability in frequency of use among adults using cannabis therapeutically.⁵¹⁻⁵⁷ While daily use among workers using cannabis for their condition in our study was less common than in some studies of medical cannabis use,⁵⁴⁻⁵⁶ it is likely a function of the nature of recruitment, whereby we included workers with varying durations of work disability. As such, workers who participated in this study are not necessarily individuals with chronic, daily symptoms, for whom we may expect daily use to be more prominent. Furthermore, we defined workers as using cannabis if they reported use more than once in the previous year, to ensure we were able to capture the extent and nature of cannabis use in this population for which little data exist. As a result, it is likely we included a diverse group of workers in our sample who ascribe varying degrees of importance to cannabis in treating their work-related condition.

Workers using cannabis for their work-related condition were also more likely to use oral oils, tinctures, and capsules, although inhalation methods were still most common, similar to other studies of individuals using cannabis for medical reasons.^{54, 55, 57, 58} They were also more likely to report either medical use only (44.9%) or mixed medical and non-medical use (46.3%). These findings are consistent with other research, which has shown a large degree of overlap with

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3 non-medical cannabis use among adults using cannabis medically,^{8, 58-62} and the blurring of
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5 boundaries between medical and non-medical use.⁶³
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11 Our study underscores the need for healthcare providers to be aware that members of their
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13 patient population who have experienced a work-related injury/illness may be using cannabis
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15 as a therapeutic measure to manage the physical and mental difficulties arising from their
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17 condition. With growing public interest in the use of cannabis for medical purposes,⁴⁻⁶ greater
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19 accessibility to legal sources of cannabis,⁶⁴ and workers' compensation organisations
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21 increasingly developing formal policies on medical cannabis,⁶⁵ it is reasonable to assume
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23 healthcare providers will continue to encounter workers using cannabis for their work-related
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25 conditions in their practice. This represents an important opportunity for healthcare providers
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27 to speak candidly with workers about their cannabis use and ensure they are supplied with
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29 evidence-based information about potential harms and benefits, to enable an informed choice
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31 about safe and effective use. Guidance from healthcare providers is all the more important
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33 given information found on the internet directed at medical cannabis consumers may be
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35 biased.⁶⁶⁻⁶⁸ In discussing cannabis use with this group of workers, healthcare providers may
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37 consider drawing from a recent clinical framework for assessing impairment risk from medical
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51 Our study provides novel information on workers' use of cannabis for their work-related
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53 conditions, a population for which little data exist. Participants were also recruited from a
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population sampling frame. There are, however, some limitations not yet described. Data were collected at 18 and 36 months after injury/illness onset and we lack information on how soon after injury/illness cannabis use was initiated. We also lack information on the duration of use, including whether there were any interruptions in cannabis use. Information on trajectories of use should be captured in future inception cohorts. Qualitative studies may also help to elucidate workers’ decision-making process around using cannabis for their work-related conditions, and the role of their healthcare providers in guiding those decisions. Due to the moderate response rates in this study, selection bias is possible if those who chose to participate differed from those who did not participate. In addition, workers with longer duration claims were oversampled. As such, workers in this study may not be representative of the source population of claimants, potentially limiting the generalisability of the findings. Further, absolute prevalence estimates of cannabis use identified in this study may not reflect the true prevalence of cannabis use in the workers’ compensation system in Ontario. Given this study takes place in the context of legalised cannabis and public healthcare, generalisability of the findings to other policy contexts may also be limited. Finally, the self-reported nature of the data may have led to some recall and social desirability bias.

Conclusion

Study findings suggest some workers use cannabis for their work-related injuries and illnesses, most commonly for pain, poor sleep and mental health. Although these workers report a beneficial impact of cannabis on their health, they are often using cannabis without medical guidance. It is important that healthcare providers caring for injured workers engage in

conversations about the potential benefits and risks associated with the therapeutic use of cannabis.

For peer review only

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Acknowledgements

We wish to express our appreciation to the members of our stakeholder advisory committee who provided input on the survey.

Competing interests

Andrea D. Furlan is a member of the Ontario Workplace Safety & Insurance Board’s Drug Advisory Committee. The authors have no other competing interests to declare.

Funding

This work was supported by the Canadian Institutes of Health Research (CIHR) (grant number PJT-173241) and the Ontario Workplace Safety & Insurance Board (grant numbers LONG2018 and MUST2021). The Institute for Work & Health receives support from Ontario’s Ministry of Labour, Immigration, Training and Skills Development. The funders had no role in the conduct of this study, in the writing of the report, or in the decision to submit the article for publication. All inferences, opinions, and conclusions drawn in this report are those of the authors and do not reflect those of the Province of Ontario.

Contributors

Cameron Mustard, Peter M. Smith, and Nancy Carnide conceived of the study. Cameron Mustard, Peter M. Smith, Nancy Carnide, and Andrea D. Furlan contributed to the study design,

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3 methods, and acquisition of funding. Colette N. Severin was the project coordinator and was
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5 responsible for development of the study instrument, ethics approval, recruitment, and data
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7 collection. Victoria Nadalin analysed the data under supervision of Nancy Carnide and Peter M.
8
9 Smith. All authors contributed to interpretation of the data. Victoria Nadalin wrote the initial
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11 draft of the manuscript and Nancy Carnide and Peter M. Smith made revisions. All authors
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13 critically reviewed and contributed to revising the manuscript for important intellectual content
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15 and approve this final version. Nancy Carnide agrees to act as guarantor of the work.
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24 **Data availability statement**

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26 Data are available upon reasonable request. Procedures to access data from this study are
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28 available through contacting the lead author (Nancy Carnide). Proposals for collaborative
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30 analyses will be considered by the study's investigator team. The study questionnaire can be
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32 provided by contacting the lead author (Nancy Carnide).
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FIGURE TITLE

Figure 1. Flow diagram of study participants included in the analysis

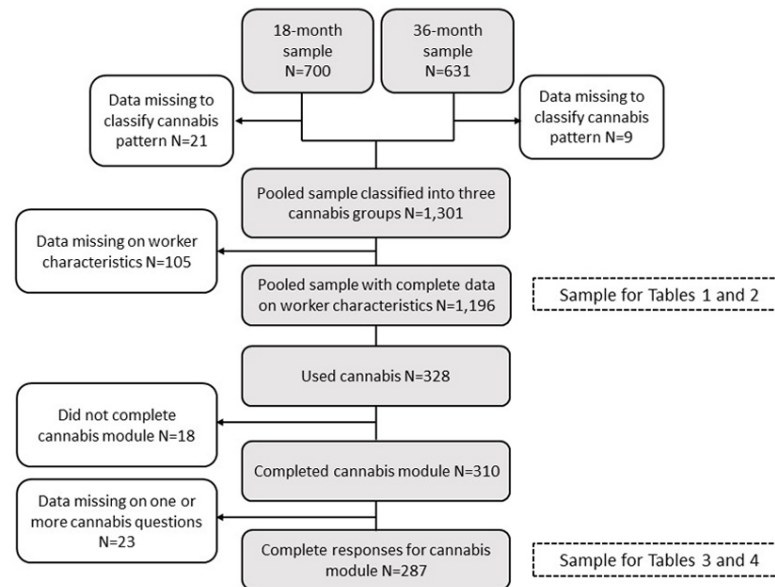


Figure 1. Flow diagram of study participants included in the analysis

Figure 1. Flow diagram of study participants included in the analysis

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Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Manuscript: Injured workers are using cannabis, often without guidance from their healthcare providers: results from a cross-sectional study of workers’ compensation claimants in Ontario

Reporting Item			Page Number
Title and abstract			
Title	#1a	Indicate the study’s design with a commonly used term in the title or the abstract	1, 2
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	#3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	#4	Present key elements of study design early in the paper	5
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-7
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5-7
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-10
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give	8-10

information separately for for exposed and unexposed groups if applicable.

Bias	#9	Describe any efforts to address potential sources of bias	5-7
Study size	#10	Explain how the study size was arrived at	5-7; 10-11; Figure 1
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Tables 1-4
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	10-11
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	N/A
Statistical methods	#12c	Explain how missing data were addressed	10-11
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	N/A
Statistical methods	#12e	Describe any sensitivity analyses	N/A
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	5-7; 10-11; Figure 1
Participants	#13b	Give reasons for non-participation at each stage	5-7
Participants	#13c	Consider use of a flow diagram	Figure 1
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	11-12; 15; Tables 1-2
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	10-11; Figure 1

1	Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	10
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6	Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11-21; Tables 1-4
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13	Main results	#16b	Report category boundaries when continuous variables were categorized	N/A
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17	Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
18				
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21	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	20
22				
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25	Discussion			
26				
27	Key results	#18	Summarise key results with reference to study objectives	22
28				
29	Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	23; 26
30				
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35	Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	22-25; 26- 27
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40	Generalisability	#21	Discuss the generalisability (external validity) of the study results	26
41				
42	Other			
43	Information			
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46	Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	28
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None The STROBE checklist is distributed under the terms of the Creative Commons Attribution License CC-BY. This checklist can be completed online using <https://www.goodreports.org/>, a tool made by the [EQUATOR Network](#) in collaboration with [Penelope.ai](#)